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ABSTRACT

This report discusses the construct and criterion-related validity of the Nebraska Wisconsin Cognitive Assessment Battery (NEWCAB), on the basis of pooled regional data collected in Iowa, Kansas, Nebraska, and Wisconsin on a 3-year longitudinal sample of 107 6-year-old, 141 7-year-old, and 160 8-year-old children. Designed to assess the cognitive development of children 3 to 5, 6 to 8, and 9 to 11 years of age, the NEWCAB assesses qualitative changes in intellectual functioning across preoperational and concrete operational Piagetian stages. Operations were assessed through 16 tasks differentially assigned according to difficulty and age levels. The three sections of the NEWCAB reflect three selected aspects of cognitive functioning: Relations, Classifications, and Number and Length. Contents of this report focus first on the objective, design, and sampling procedures of the longitudinal study, the Life Span Analysis of Mental and Social Development of Rural Children, for which NEWCAB was especially developed. Subsequently, the development, validity, and reliability of the NEWCAB, based on Nebraska data, are reported. Then, the validity of NEWCAB, with regard to regional data, is discussed. It is tentatively concluded that the construct and criterion-related validity of the NEWCAB are empirically verifiable and that the battery has potential for use in assessing children's cognitive development. (RH)

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Nebraska Wisconsin Cognitive Assessment Battery (NEWCAB)

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Nebraska Wisconsin Cognitive Assessment Battery (NEWCAB)

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Several years ago eight midwestern states of USA participated in a three year longitudinal regional research project, NC-124: Life Span Analysis of Mental and Social Development of Rural Children. NEWCAB was especially developed for NC-124 for the cognitive assessment of 3-11 year old children under the leadership of the participating scientists of Nebraska (V. Kalyan-Masih) and Wisconsin (W. Marshall).

This report, however, will discuss the construct validity of NEWCAB derived from the pooled regional data collected by four of the states--Iowa, Kansas, Nebraska, and Wisconsin, on the three-year longitudinal sample of 107 6-year, 141 7-year, and 160 8-year old children.

The outline of the paper will be: 1) NC-124--objective, design, and sampling procedures, 2) NEWCAB--development, validity and reliability from Nebraska data; and 3) Validity of NEWCAB from the regional data.

1. The NC-124

Objectives: Some of the main objectives of the project were: to investigate over time cognitive and social development of rural children; to describe family attitudes, demographic characteristics, child care patterns of rural families; and to analyze over time the influence of family characteristics on rural children's development.

Design and Sampling Procedures: A repeated measure three year longitudinal design was used. The three age groups of children and their parents were assessed three times at approximately one year intervals with the same assessment instruments. Each participating state was to start with 40 children, 20 males and 20 females in each age range of 3-3 1/2 years, 6-6 1/2 years, and 9-9 1/2 years. These children with their 120 parents continued for three years. Nebraska supplemented the basic sample with a control group of at least 20 children, added to each age group at the time of 2nd and 3rd assessment to check for repeated test effects. Due to financial considerations some states decided to use a basic sample smaller than 120 children and 120 families. The sampling procedures, however, had to meet the NC-124 guidelines of representative randomness stratified by defined criteria

of ruralness (residence, farm derived income) and family intactness. Subjects could be randomly selected from the entire state or from subregions within a state such as, counties and segments within the counties; soil types and segments within soil types; and total list of farms within a region of the state.

2. The Nebraska Wisconsin Cognitive Assessment Battery (Kalyan-Masih, Marshall et al, 1981, pp. 245-258)

The Nebraska Wisconsin Cognitive Assessment Battery was designed to assess the cognitive development of children of 3 to 5, 6 to 8, and 9 to 11 years of age. It assesses qualitative rather than quantitative changes in intellectual functioning over time. The broad age range of 3 to 11 years includes two Piagetian stages, that is, preoperational (3 to 7 years) and concrete operational (8 to 11 years). The operations selected for assessment are Relations, Classifications, Number-Length. Younger children functioning within the preoperational period are not expected to show a mastery of these operations, but over a period of three years as their cognitive structures develop, corresponding improvement in their cognitive performance is expected. Some older children may show a mastery of these operations at an earlier or even later age. These differential rates of growth are

recognized in the administrative procedures where children may be assessed at a higher or lower level than that specified by their chronological age.

The purpose of the NEWCAB, then, is: 1) to assess the cognitive status of a child within Piagetian theory, and 2) to determine cognitive changes over a period of time. The assessment of cognitive status and change is restricted to the 3 to 11 age range and by inference to preoperational and concrete operational cognitive levels.

Development of the NEWCAB

After pilot testing, procedural modifications were refined and scoring protocols were expanded. The battery went through three revisions before the present standardized format was devised as a result of the joint efforts of Nebraska (V. Kalyan-Masih) and Wisconsin (W. Marshall) scientists participating in this study.

The NEWCAB consists of:

1. The NEWCAB Manual. The 79-page manual contains: purpose of the cognitive task, description of testing materials, standardized instructions for administering and scoring, and suggestions for interpreting the scores for each of the 16 tasks included in the battery.

2. The NEWCAB Testing Kit. A small cardboard box containing toy type testing materials such as cardboard trees, pots, wooden hurdles, plastic chips, etc.

The primary consideration in developing the NEWCAB was that the selected Piagetian tasks should provide a valid measure of cognitive structures selected for study and that the assessment materials be appealing to children and easy for them to handle. All the tasks in the battery are modified versions of original Piagetian tasks and/or derived from the theory.

There are three sections in the NEWCAB reflecting three selected aspects of cognitive functioning: Relations, Classification, and Number and Length. The NEWCAB is comprised of a total of 16 tasks differentially assigned to the three sections. Within each section these 16 tasks are arranged in an ascending order of difficulty (easiest for the younger child and more difficult for the older). The assignment of tasks according to difficulty and age levels reflects the Piagetial framework. Of these 16 tasks, six (CT_1, CT_2, CT_3, CT_4, NLT_2 and NLT_3) were developed at the Wisconsin Research and Development Center for Cognitive Learning (Hooper, Brainerd, Sipple, 1975), and the remaining 10 tasks were developed at the Nebraska Station.

Table 1 shows the arrangement of the 16 tasks in each section according to assumed order of difficulty and age level:

(Insert Table 1 About Here)

Validity

Three kinds of validity have been suggested in The Standards for Educational and Psychological Tests and Manuals (French and Michael, 1966): content validity, criterion-related validity, and construct validity. Since the NEWCAB is derived from the Piagetian theory the claim for its validity is essentially of the "construct validity" type. Criterion-related validity may also be considered by correlating the performance on NEWCAB with two external criteria: the WISC-R and Peabody Picture Vocabulary Test.

A. Construct-Validity

Construct-validity refers to the degree to which performance scores may be explained by theoretical assumptions and constructs of a theory. The basic theoretical assumptions of the NEWCAB are:

1. That cognitive changes proceed in an orderly sequence.

2. That cognitive changes are qualitative rather than quantitative.
3. That these cognitive (structural) changes may be inferred from differential performance on cognitive tasks.
4. That these structural changes do not remain isolated but are integrated and coordinated into higher order structures which in turn permit cognitive functioning at a higher level.

An earlier analysis of Nebraska data provides tentative empirical support for the "construct validity" of the NEWCAB in that the four assumptions are supported by the data.

B. Factor Analysis

Further evidence for the validity of NEWCAB was obtained from factor analysis of the Nebraska data collected for the 5-, 8-, and 11-year old children at the third/final testing.

(Insert Table 2 About Here)

Table 2, A shows the initial factor matrix for 73 5-year-old children at third testing using total scores on the NEWCAB tasks in the zero order correlation matrix. With a minimum eigenvalue of 1.0, two factors are retained in a principal components procedure. This two factor solution

accounts for 65.9 percent of the total variance of the variables. A varimax rotation results in the factor loadings presented in Table 2, B. Thus for 5-year-old children, cognitive tasks, RT1, RT2, and CT1 load on factor 1; and NLT1, NLT2 and NLT3 load on factor 2.

(Insert Table 3 About Here)

Table 3, A shows the initial factor matrix for 76 8-year-old children at third testing using total scores on the NEWCAB tasks in the zero order correlation matrix. With a minimum eigenvalue of 1.0, three factors are retained in a principal component solution procedure. This three factor solution accounts for 84.4 percent of the total variance of the variables. A varimax rotation results in the factor loadings presented in Table 3, B. For the 8-year-old children, the cognitive tasks NLT4 and NLT5 load on factor 1. Factor 2 consists of loadings from RT3 and RT4 and the cognitive tasks CT2 and CT3 are the signigicant contributors to factor 3.

(Insert Table 4 About Here)

Table 4, A shows the initial factor matrix for 73 11-year-old children at third testing using total scores on the NEWCAB tasks in the zero-order correlation matrix. With a minimum eigenvalue of 1.0, two factors are retained in a principal components procedure. This two factor solution accounts for 68.8 percent of the total variance of the variables. A varimax rotation results in the factor loadings presented in Table 4, B. For 11-year-old children, RT5 and RT6 load on factor 1 and CT4 and NLT6 contribute to factor 2.

Thus we note that at each age level, this factor analysis lends support to the theory-derived cognitive structures.

C. Criterion-Related Validity

Although the NEWCAB derives its basic support for construct-validity from the theory itself, criterion-related validity may also be considered. NEWCAB scores may be correlated with WISC-R and Peabody Picture Vocabulary Test, the latter two standardized measures being the external criteria. An examination of some of the correlation coefficients in Table 8, 9, and 10 provides empirical support for the "criterion-related validity" of the NEWCAB.

(Insert Tables 5, 6, and 7 About Here)

At age 5, significant correlations between total NEWCAB and PPVT-IQ was .41, $p<.001$; at age 8, .26, $p<.05$; and at age 11, .16 $p<.10$. The correlations between total NEWCAB and four subscales of WISC-R (Vocabulary, Information Picture Completion, Block Design) at age 8 were .34, .31, .37, and .38, $p<.01$ respectively. At age 11, the correlations with Information and Block design were .34 and .32 respectively, at the significance level of .01.

Reliability

Reliability refers to the consistency of measurement. Classical estimates of reliability such as test-retest reliability, equivalent form reliability or measures of internal consistency (split-half, odd-even, K-R-20) may not be very meaningful for determining the reliability of the NEWCAB.

Reliability could be also inferred from examining the stability in performance from t_1 to t_2, t_2 to t_3, and t_1 to t_3. Raw scores indeed would be changing (increasing or decreasing) across time, but the relative performance of children with respect to each other in the same sample should be maintained. Stability in performance will be inferred if the correlation coefficients are approximately equal from t_1 to t_2, t_2 to t_3, and t_1 to t_3 on a cognitive task. Analysis of Nebraska data suggests this to be the case. For age level 3 to 5, some stability in performance was inferred from

approximately equal r's on RT1 (.22, .24, .36); and NLT1 (.32, .44, .40) from t_1 to t_2, t_2 to t_3, and t_1 to t_3 respectively. For age level 6 to 8, some stability in performance was inferred from approximately equal r's on RT3 (.31, .27); NLT4 (.25, .32): CT3 (.68, .65) from t_2 to t_3, and t_1 to t_3; CT2 (.30, .30) from t_1 to t_2, and t_1 to t_3 respectively. For age level 9 to 11, some stability in performance was inferred from approximately equal r's on RT6 (.49, .40); NLT5 (.60, .66) from t_1 to t_2 and t_2 to t_3 respectively; RT5 (.20, .23) from t_1 to t_2 and t_1 to t_3; NLT6 (.36, .37) from t_2 to t_3 and t_1 to t_3 respectively. Nearly all r's are significant at .05. It may, therefore, be reasonable to assume that most NEWCAB tasks show relative stability or reliability in assessment across time. For age level 3 to 5, RT1 and NLT1 show relative stability in performance across three years; for age level 6 to 8, RT3, CT2, CT3, and NLT4 show relative stability across two years; and for age level, 9 to 11, RT5, RT6, NLT5, and NLT6 show relative stability in performance across two years.

3. Validity of NEWCAB derived from the Regional data

Regional data collected by Iowa, Kansas, Nebraska and Wisconsin for 6-, 7-, and 8-year old children at first, second, and third testing was pooled together for factor analysis to further examine the validity of NEWCAB. The sample consisted of a total of 107 6-year, 141 7-year, and 160

8-year olds tested individually three times with six of the sixteen NEWCAB tasks: Relations 3 and 4; Classification 2 and 3; and Numbers 4 and 5 (RT_3, RT_4, CT_2, CT_3, NLT_4, and NLT_5).

Details of Regional Sample

	Year 1 6 Year Olds	Year 2 7 Year Olds	Year 3 8 Year Olds
Iowa	33	37	37
Kansas	19	22	21
Wisconsin	18	26	26
Nebraska	37	56	76
Total	107	141	160

Nebraska station had added control cohorts at the second and third testing to check for the repeated test effects as shown below.

Details of Nebraska Sample

	Year 1 6 Year Olds	Year 2 7 Year Olds	Year 3 8 Year Olds
	37	37	37
		+19	19
			+20
Total	37	56	76

ANOVA showed no significant differences in performance between the longitudinal and control cohorts of Nebraska sample, thus ruling out repeated test effects.

The construct and criterion-related validity of NEWCAB for the Nebraska Sample, 5-, 8-, and 9-year old children, has

already been discussed. The combined regional data of four states will now be used to examine further the construct validity via factor analysis.

Table 8, A shows the initial factor matrix for 107 6-year old children using total NEWCAB scores in the zero order correlation matrix. Using the Kaiser criterion (eigenvalues > 1), three factors are retained in a principal component procedure. A varimax rotation suggested a three-factor solution, accounting for 69.7% of total variance of the six variables. For the variable-factor identification a cut-off value of >0.40 for the loading of variables with a factor was established. Table 8, B shows the varimax rotated factor matrix with three significant factors. Two variables, NLT_4 and NLT_5 load on Factor 1 with significant factor loadings of .82 and .89 respectively. CT_2 and CT_3 load on Factor 2 with factor loadings of .83 and .75 respectively. RT_3 and RT_4 loaded on Factor 3 with factor loadings of .89 and .59 respectively.

A brief description of RT_3, RT_4, CT_2, CT_3, NLT_4 and NLT_5 will now follow (Refer to the NEWCAB Manual for a fuller description) because what each task measures has relevance for explaining the factors structure.

Relations Task 3/RT_3 measures the child's ability to insert additional elements in an already completed series,

that is, inserting six additional tress (t_1, $t_2 \ldots t_6$) graduated in size, in an already completed series of seven trees (T_1, $T_2 \ldots T_7$). To complete this task successfully, the child has to understand that a tree t_1 is bigger than T_1 and smaller than T_2 at the same time. The concept of relative size of an element is essential for inserting t_1, $t_2 \ldots t_6$ within the series of T_1, $T_2 \ldots T_7$. The new integrated series would be T_1 t_1 T_2 $t_2 \ldots t_6$ T_7.

Relations Task 4/RT_4 is designed to measure how the child finds serial correspondence between the elements of two series when one of the series is disarranged. Seven trees are arranged in a row in an ascending order from the smallest to the largest. Seven pots are also arranged in a row from the smallest to the largest. Serial correspondence between the trees and pots is established, that is, the child identifies the 5th pot that corresponds with the 5th tree. The pots are displaced in three different ways. After each displacement the child is questioned about the serial correspondence between a tree and a pot, that is, he is expected to identify a pot that will go with the third or fifth or seventh tree. RT_3 and RT_4 deal with arranging elements in an ascending or descending order, maintaining that order while inserting new elements; and conserving serial correspondence between the elements of two ordered series. The underlying logical

structure of RT_3 and RT_4, then, deals with seriation/putting elements in an ordered way. These two variables have significant factor loadings of .89 and .59 on Factor 3.

Classification Task 2/CT_2 measures child's ability to understand relations between subclasses, A, A' and superordinate class, B; that is, A+A'=B; B-A=A'; and B-A'=A. The task material consists of three red triangles, two blue triangles, and four blue circles. The child is asked "all-some" questions such as, are all the circles blue? This requires comparing the superordinate class (circles) with subclasses (green, blue, red).

Classification Task 3/CT_3 measures child's ability for combinatorial reasoning. The child makes pairs first with 40 chips (10 red, 10 green, 10 yellow and 10 blue chips) and then with 60 chips (with additional 10 white and 10 orange chips). Two rules have to be followed: 1) each pair of chips must have two different colors; and 2) each new pair of chips must be formed with two colors not used before. To succeed on this task the child has to use a systematic approach with consistent application of the two rules. The underlying structure of CT_2 and CT_3 deals with classificatory logic and has factor loadings of .83 and .75 on Factor 2.

The purpose of Number-Length Task 4/NLT_4 is to measure the stability of the conservation of number and length in a

conflict situation. The child has to construct two equivalent streets, A and B with small and large sticks. Four large sticks are needed for street A which has four houses on it. Six small sticks are needed for street B which has six houses on it. Can the streets A and B be equal in length when there are 4 sticks vs. 6 sticks or 4 houses vs. 6 houses? Conservation of length is further checked by arranging four or six sticks in different ways.

Number-Length Task 5/NLT_5 measures the child's ability to find the relationships between cardinal an ordinal number. Ten hurdles are arranged in an ascending order. There are eleven small green mats--one mat is placed before each of the ten hurdles and the eleventh mat is placed after the tenth hurdle. To clear the third hurdle, the dolly has to jump over three hurdles and touch four mats; or in order for the dolly to touch eight mats, it has to jump over seven hurdles. The child has to deduce two rules; if n hurdles are jumped then the number of mats touched must be n+1; or, if n mats are touched, then, the number of hurdles jumped must be n-1. The NLT_4 and NLT_5 have significant factor loadings of .82 and .89 on Factor 1. Thus for the six-year old children we find that a theoretical logical structure of Seriation, Classification, and Number-Length is also empirically verified by a three-factor solution.

Table 9, A, shows the initial factor matrix for 141 7-year old children using total NEWCAB scores in the zero order correlation matrix. Following the same procedures for factor analysis as described for the 6-year old children, Table 9, B, shows the varimax rotated factor matrix. Three factors explain 79% of total variance of the six variables. Two variables, NLT_4 and NLT_5 have siginificant factor loadings of .93 and .93 respectively on Factor 1. RT_3 and RT_4 load on Factor 2 with factor loadings of .90 and .90 respectively. CT_2 and CT_3 have significant loadings of .85 and .75 respectively on Factor 3. For the 7-year old children also we find that a theoretical logical structure of Seriation, Classification, and Number-Length is empirically verified by a three-factor solution.

Table 10, A shows the initial factor matrix for 160 8-year old children Table 10, B, shows the varimax rotated factor matrix. Two factors explain 65% of total variance of the six variables. RT_3, CT_2, CT_3 and NLT_4 have loadings of .84, .87, .53 and .56 respectively on Factor 1. RT_4, NLT_4 and NLT_5 have loadings of .58, .70 and .87 respectively on Factor 2. NLT_4 cross loads on both Factors 1 and 2.

The analysis of regional data for 6-, 7-year old children confirms the construct validity of three logical operations of Seriation, Classification and Number-Length. Two Seriation

tasks, two Classification tasks, and two Number-Length tasks load on three factors. The factor analysis for 8-year old children identified two factors validating the correspondence between structures of logical operations and empirically derived factor pattern. The reduction in the number of factors from three for the 6-, 7-year old children to two for the 8-year old children suggests a trend for the integration of logical operations towards what Piaget calls "structure d'ensemble" as the children attain a particular cognitive developmental level.

Insert Tables 11 and 12 About Here

The criterion-related validity was confirmed by significant and positive correlations of NEWCAB tasks with PPVT IQ and four subscales of WISC-R on the Nebraska date. Block Design correlated with most of the NEWCAB variables--with RT_3, CT_3, and NLT_5 for 6-year olds; with RT_3, RT_4, CT_2, and NLT_5 for 7-year olds; and with RT_3, CT_2, and NLT_4 for 8-year olds.

Therefore, it is tentatively concluded that the construct and criterion-related validity of NEWCAB is empirically varifiable and that it has potential for the cognitive assessment of children.

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Table 1

Arrangement of NEWCAB Tasks According to Age Level

	RELATIONS	CLASSIFICATION	NUMBER AND LENGTH
	RT 1	CT 1	NLT 1
3-5 yr. olds	1. Simple Seriation (7 trees)	1. Free Sorting and Specified Sorting	1. Cardinal Correspondence (10 trees and 10 pots)
	RT 2		NLT 2
	2. Double Seriation without Transformation (7 trees and 7 pots)		2. Length Identity
			NLT 3
			3. Length Equivalence
	RT 3	CT 2	NLT 4
6-8 yr. olds	3. Additive Seriation	2. Some-All	4. Number and Length Conflict (Houses and Streets)
	RT 4	CT 3	
	4. Double Seriation Transformation (7 trees and 7 pots)	3. Class Inclusion	NLT 5
			5. Cardinal and Ordinal Correspondence (10 hurdles and 11 mats)
	RT 5	CT 4	NLT 6
9-11 yr. olds	5. 16 Element Matrix (Apples)	4. Combinatorial Reasoning	6. Proportional Reasoning (Rabbit Hop)
	RT 6		
	6. Verbal Seriation		

Table 2

Factor Matrix: 5-Year-Olds
Nebraska, N=73

Variables	A Initial Factor Matrix Factor 1	Factor 2	B Varimax Rotated Factor Matrix Factor 1	Factor 2
RT 1 Total	0.49	-0.45	0.94*	0.11
RT 2	0.47	-0.40	0.88*	0.14
CT 1 Total	0.29	-0.20	0.51*	0.12
NLT 1 Total	0.37	0.11	0.38	0.49*
NLT 2 Total	0.43	0.51	0.15	0.89*
NLT 3 Total	0.37	0.56	0.05	0.89*
Eigenvalue	2.63	1.33		
Pct. of Variance	43.8	22.1		
Cum. Pct. of Variance	43.8	65.9		

* Significant factor loadings.

Table 3

Factor Matrix: 8-Year-Olds
Nebraska, N=76

Variables	A Initial Factor Matrix			B Varimax Rotated Factor Matrix		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
RT 3 Total	0.43	-0.50	-0.10	0.15	0.88*	0.16
RT 4 Total	-0.38	0.55	0.23	-0.09	-0.92*	0.00
CT 2	0.22	-0.27	0.73	-0.14	0.27	0.86*
CT 3	0.33	0.32	0.56	0.47	0.16	0.72*
NLT 4 Total	0.53	0.34	-0.22	0.93*	0.21	0.04
NLT 5 Total	0.49	0.41	-0.19	0.93*	0.08	0.04
Eigenvalue	2.43	1.51	1.12			
Pct. of Variance	40.6	25.1	18.7			
Cum. Pct. of Variance	40.6	65.7	84.4			

* Significant factor loadings.

Table 4

Factor Matrix: 11-Year-Olds
Nebraska, N=73

Variables	A Initial Factor Matrix Factor 1	Factor 2	B Varimax Rotated Factor Matrix Factor 1	Factor 2
RT 5 Total	0.69	-0.13	0.89*	0.18
RT 6	0.65	-0.33	0.91*	-0.04
CT 4 Total	0.20	0.69	0.00	0.76*
NLT 6 Total	0.26	0.63	0.10	0.72*
Eigenvalue	1.69	1.05		
Pct. of Variance	42.4	26.5		
Cum. Pct. of Variance	42.4	68.8		

* Significant factor loadings.

Table 5

Correlation Coefficients Among NEWCAB Tasks and PPVT-IQ for 5 Year Old Ss

N=74	RT#1	RT#2	CT#1	NLT#1	NLT#2	NLT#3	NEWCAB Total	PPVT-IQ
Relations #1	1.00							
Relations #2	0.48****	1.00						
Classification #1	0.37****	0.06	1.00					
Number-Length #1	0.30***	0.22**	0.22**	1.00				
Number-Length #2	0.31***	0.08	0.09	0.33***	1.00			
Number-Length #3	0.00	0.27	0.35	-0.41*	0.07	1.00		
NEWCAB Total	0.63****	0.43****	0.42****	0.81****	0.65****	0.89****	1.00	
PPVT-IQ	0.18*	0.36**	0.33***	0.29***	0.30**	0.44*	0.41****	1.00

*p<.10
**p<.05
***p<.01
****p<.001

Table 6

Correlation Coefficients Among NEWCAB Tasks
PPVT-IQ and WISC-R sub-scales for 8 Year Old Ss

N=76	RT3	RT4	CT2	CT3	NLT4	NLT5	NEWCAB Total	PPVT-IQ	WISC-V	WISC-R-I	WISC-R-PC	WISC-R BD
Relations 3	1.00											
Relations 4	-0.00	1.00										
Classification 2	0.27***	0.04	1.00									
Classification 3	0.01	0.19*	0.13	1.00								
Number-Length 4	0.30***	-0.14	0.00	0.37****	1.00							
Number-Length 5	0.01	0.16	0.13	0.14	0.11	1.00						
NEWCAB Total	0.55****	0.01	0.21**	0.42****	0.87****	0.71****	1.00					
PPVT-IQ	0.20**	0.07	0.14	0.18*	0.17*	0.06	0.26**	1.00				
WISC-R												
Vocabulary	0.27***	0.19*	0.22**	0.17	0.24**	0.36**	0.34****	0.47****	1.00			
Information	0.24**	-0.03	0.19**	0.11	0.29***	0.14	0.31***	0.39****	0.48****	1.00		
Picture Completion	0.33***	0.20*	0.20*	0.20**	0.21**	0.48****	0.37****	0.15*	0.39****	0.25**	1.00	
Block Design	0.46****	0.08	0.21*	0.13	0.30***	-0.03	0.38****	0.16*	0.42****	0.36****	0.33***	1.00

*p<.10
**p<.05
***p<.01
****p<.001

Table 7

Correlation Coefficients Among NEWCAB, PPVT AND WISC-R for 11 Year Old Ss

	RT5	RT6	CT4	NLT6	NEWCAB Total	PPVT IQ	WISC-R VS	WISC-R IS	WISC-R PCS	WISC-R BDS
RT5	1.00									
RT6	.18*	1.00								
CT4	.12	.05	1.00							
NLT6	.19**	-.13	.11	1.00						
NEWCAB Total	.56****	.22*	.77****	.56****	1.00					
PPVT-IQ	.10	-.04	-.05	.05	.16*	1.00				
WISC-R										
Vocabulary	.20**	-.16	-.11	.16*	.18*	.63****	1.00			
Information	.15	.11	.09	.16*	.34***	.63****	.61****	1.00		
Picture Completion	-.01	.03	-.07	-.03	.08	.53****	.46****	.66****	1.00	
Block Design	.17*	.07	.18*	.15	.32***	.23**	.19*	.29*	.46****	1.00

*p<.10
**p<.05
***p<.01
****p<.001

Table 8

Factor Matrix: 6-Year-Olds
Four States, N=107

Variables	A Initial Factor Matrix			B Varimax Rotated Factor Matrix		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
RT 3	.14	.09	.89	.11	-.13	.89*
RT 4	.56	.32	.38	-.36	.29	.59*
CT 2	-.09	.84	-.16	.22	.83*	.01
CT 3	.27	.68	-.22	-.17	.75*	.02
NLT 4	.81	-.12	-.10	-.82*	.03	.11
NLT 5	-.82	.25	.26	.89*	.06	.05
Eigenvalue	1.74	1.35	1.09	These three factors explain 69.7% of total variance of the variables.		
Pct. of Variance	28.9	22.5	18.3			
Cum. Pct. of Variance	28.9	51.4	69.7			

* Significant factor loadings.

Table 9

Varimax Rotated Factor Matrix by States: 6 Year Olds

Variables	Nebraska, N=37			Iowa, N=33		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
RT 3	-.06	.78*	-.32	.05	.88*	.01
RT 4	-.18	.84*	.24	-.75*	-.02	.22
CT 2	.42*	.42*	.63*	.20	-.47*	.76*
CT 3	-.18	-.15	.81*	-.23	.18	.85*
NLT 4	-.88*	.08	-.08	-.48*	-.67*	.09
NLT 5	.85*	-.15	-.17	.84*	.18	.15

These factors explain 75% of total variance of the variables.

Variables	Wisconsin, N=18		Kansas, N=19		
	Factor 1	Factor 2	Factor 1	Factor 2	Factor 3
RT 3	.28	.66*	.10	.87*	.18
RT 4	-.21	.89*	-.20	.01	.81*
CT 2	.78*	-.20	.87*	.08	-.18
CT 3	.67*	.29	.79*	-.08	.19
NLT 4	.70*	.04	.20	-.05	.69*
NLT 5	.00	.00	.10	.83*	-.25
	These two factors explain 59% of total variance of the variables.		These three factors explain 71% of total variance of the variables.		

* Significant factor loadings.

Table 10

Factor Matrix: 7 Year Olds
Four States, N=141

Variables	A Initial Factor Matrix			B Varimax Rotated Factor Matrix		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
RT 3	.21	.83	-.30	.02	.90*	.08
RT 4	.31	.81	-.29	-.09	.90*	.06
CT 2	-.02	.39	.76	-.12	.02	.85*
CT 3	-.33	.47	.52	.25	.12	.75*
NLT 4	-.90	.16	-.18	.93*	-.02	.06
NLT 5	.91	-.12	.19	-.93*	.04	-.04
Eigenvalue	1.88	1.75	1.09			
Pct. of Variance	.31	.29	.18			
Cum. Pct. of Variance	.31	.60	.78			

*Significant factor loadings
These three factors explain 79% of total variance of variables.

Table 11

Varimax Rotated Factor Matrix by States: 7 Year Olds

Variables	Nebraska, N=56			Iowa, N=37		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
RT 3	-.02	.94*	.18	.05	.84*	-.16
RT 4	-.14	.95*	-.01	.25	.82*	.19
CT 2	.00	.12	.89*	.03	.22	-.68*
CT 3	.18	.03	.88*	.01	.25	.77*
NLT 3	.98*	-.03	.07	-.89*	-.13	.04
NLT 4	-.96*	.14	-.12	.89*	.12	.01
	These three factors explain 90% of total variance of the variables.			These three factors explain 72% of total variance of the variables.		

Variables	Wisconsin, N=26			Kansas, N=22		
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3
RT 3	.79*	-.19	.21	-.02	-.10	.98*
RT 4	.66*	.14	.22	.18	.86*	-.08
CT 2	.12	.83*	-.13	.00	-.00	.00
CT 3	-.04	.82*	.21	-.13	.87*	.10
NLT 3	.13	.06	.92*	-.91*	.14	.30
NLT 4	.76*	.17	-.32	.94*	.11	.22
	These three factors explain 88% of total variance of the variables.			These three factors explain 88% of total variance of the variables.		

* Significant factor loadings.

Table 12

Factor Matrix: 8-Year-Olds
Four States, N=160

Variables	A Initial Factor Matrix Factor 1	Factor 2	B Varimax Rotated Factor Matrix Factor 1	Factor 2
RT 3	-.57	.70	-.84*	-.33
RT 4	.19	.56	-.11	-.58*
CT 2	.76	-.44	.87*	.01
CT 3	.64	.04	.53*	-.35
NLT 4	.83	.34	.56*	-.70*
NLT 5	-.42	-.77	.01	.87*
Eigenvalue	2.21	1.71		
Pct. of Variance	.37	.28		
Cum. Pct. of Variance	.37	.65		

*Significant factor loadings

These two factors explain 65% of total variance of variables.

Table 13

Varimax Rotated Factor Matrix by States: 8 Year Olds

Variables	Nebraska, N=76			Iowa, N=37	
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2
RT 3	.15	.91*	.12	-.77*	.04
RT 4	.08	.93*	.05	.23	-.40*
CT 2	-.17	.28	.83*	.93*	-.01
CT 3	.43*	-.11	.75*	.17	-.69*
NLT 4	.97*	.15	.07	.73*	-.40*
NLT 5	-.97*	-.11	-.04	.15	.87*
	These three factors explain 87% of total variance of the variables.			These two factors explain 61% of total variance of the variables.	

Variables	Kansas, N=21			Wisconsin, N=26	
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2
RT 3	.95*	.00	-.15	.45*	.50*
RT 4	-.00	.00	-.00	.25	.67
CT 2	.07	.89*	.01	-.79*	.17
CT 3	.09	.87*	.10	.21	-.67*
NLT 4	-.85*	-.15	-.38*	.88*	.07
NLT 5	.04	.05	.98*	.08	-.44*
	These three factors explain 87% of total variance of the variables.			These two factors explain 52% of total variance of the variables.	

* Significant factor loadings.

Table 14

Intercorrelations Among PPVT-IQ and NEWCAB Tasks for Nebraska Data

Variables		6-Year-Olds N=37	7-Year-Olds N=56	8-Year-Olds N=76
PPVT with	RT_3	--	.22**	.20*
	RT_4	.23*	.23**	--
	CT_2	--	--	--
	CT_3	--	.23**	.18*
	NLT_4	--	--	.17*
	NLT_5	.54***		

*p<.10
**p<.05
***p<.01

Table 15

Intercorrelations Among NEWCAB and WISC Subscales for Nebraska Data

6-Year-Olds N=37			7-Year-Olds N=56			8-Year-Olds N=76		
WISC-VS	RT_3	.21*	WISC-VS	RT_3	.43*	WISC-VS	RT_3	.27**
WISC-IS	NLT_5	.43		CT_2	.19*		RT_4	.19
WISC-PC	CT_3	.22*	WISC-IS	RT_3	.45*		CT_2	.22*
WISC-BD	RT_3	.33		CT_2	.39*		CT_3	.17
	CT_3	.32		NLT_5	.54*		NLT_4	.24*
	NLT_5	.32*	WISC-PC	RT_3	.34*		NLT_5	.36*
				RT_4	.25*	WISC-IS	RT_3	.24*
				CT_2	.26*		CT_2	.19*
				NLT_5	.69**		NLT_4	.29**
			WISC-BD	RT_3	.63*	WISC-PC	RT_3	.33**
				RT_4	.21*		RT_4	.20
				CT_2	.28*		CT_2	.20
				NLT_5	.53*		CT_3	.20
							NLT_4	.21*
							NLT_5	.48**
						WISC-BD	RT_3	.46**
							CT_2	.21
							NLT_4	.30**

Unstarred pairs correlated at $p<.10$
*$p<.05$
**$p<.01$